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ABSTRACT

This report profiles the development, implementation, and evaluation of an interactive videodisc-based (IVD) program, Physical Sciences: Discovery through Interactive Technology. Developed by the Texas Learning Technology Group (TLTG), the program is a comprehensive, 160-hour, two-semester curriculum for secondary school students that integrates teacher/student interactions, teacher demonstrations, and traditional wet labs with an interactive videodisc instructional delivery system. The courseware is designed as a teaching tool and consists of 15 videodisc sides, accompanying software, Teacher Resource Guide, Student Manual, and Assessment Program. Teacher input was solicited with regard to instructional design, and teacher training was a major component of program development. The chemistry semester of the courseware was pilot tested during the 1987-88 school year with 2,000 students in 12 school districts. Evaluation focused on student achievement and interest. On the average, students enrolled in the interactive videodisc program reached higher levels of achievement then students in a traditional class. Differences were greatest between low-ability students in the interactive videodisc program and in the traditional class. Students enrolled in the program expressed a more positive intention of taking additional science classes as electives than did students in traditional classes. TLTG is a partnership among the Texas Association of School Boards, 12 school districts, and the National Science Center Foundation, Inc. (EW)

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PHYSICAL SCIENCE:

DISCOVERY THROUGH INTERACTIVE TECHNOLOGY

Status and Evaluation

ED307843

History of TLTG

Formation of TLTG

A crisis in public education, particularly in mathematics, science, and technology, has been documented by numerous studies during the last decade. Studies point to a significant decline in the number of people prepared to teach science, the inconsistent quality of science education, the low number of students enrolling in advanced science classes, and the generally low achievement of minority and female students in science. Furthermore, high school graduates are not prepared to work with advanced technology required in business and industry.

The Texas Association of School Boards (TASB) Board of Trustees responded to the identified crisis in science, mathematics, and technology by creating a partnership of the National Science Center Foundation, Inc. (NSCF), TASB, and 12 Texas school districts. The goal of this consortium was to involve educational groups in the uses of technology in public school instruction. Toward this end, the Texas Learning Technology Group (TLTG) was established in September 1985 as a nonprofit organization with a board of 15 directors.

TLTG was formed to (a) develop high-quality curriculum projects that integrate new technologies into curriculum delivery systems, (b) evaluate the effectiveness of a technology-based curriculum, and (c) train teachers in the use of new technologies and provide support to schools implementing these new, technologically advanced curricula.

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Planning

TLTG's first task was to find practical ways of bringing technology into the classroom. TLTG contracted with AT&T to help accomplish this goal. Next, TLTG formed planning committees, each comprising science teachers, technical advisors, and management personnel from school districts, the Texas Education Agency, and Texas universities. The four planning committees were:

- The curriculum committee
- The teacher training committee
- The technical committee
- The evaluation committee

The curriculum committee was charged with determining the type of course TLTG would develop and with recommending the curriculum. As a result of the committee's findings, TLTG decided to develop a complete physical science curriculum. The committee recommended a science course, instead of a course such as English or Hisory, because members saw a shortage of science teachers and resulting decline in the quality of science courses. They chose physical, rather than biological or earth, science because they perceived this teacher shortage, as well as a lack of student motivation, to be most critical in this particular type of course. Furthermore, school personnel wanted a course that would improve student achievement in science and motivate students to take more elective science courses. So the committee recommended a complete curriculum, rather than supplementary materials, be developed to provide teachers with a cohesive, flexible, and highly interactive set of information.

The teacher training committee's responsibility was to outline the goals of the teacher training program. In accordance with TLTG's philosophy, the committee recommended teacher training be viewed as a critical component of the curriculum. The committee decided that teachers pilot testing the curriculum should receive training prior to, during, and after the pilot. The training sessions would address skills and knowledge needed to teach the course, and explore how the electronic curriculum would affect the role of the teacher.

The technical committee, instructed to determine the technological delivery system that would best meet TLTG's goals, recommended using interactive videodisc (IVD). This technology combines the power of the three most effective technology tools used today - text, video, and the computer. The committee members also thought its visual capabilities would be well suited to teaching science. Although very little research was available on the effectiveness of interactive video, preliminary reports indicated that it increased student achievement and reduced learning time.

In determining what type of evaluation would best measure the success of the project, the evaluation committee recommended teacher and student attitudes and student achievement be examined. TLTG contracted the Educational Productivity Council (EPC), a research group at the University of Texas at Austin, to conduct this evaluation. Additionally, TLTG staff members were charged with informally examining teacher implementation, the effect of certain design decisions on the courseware's effectiveness, and teacher and student perceptions of the curriculum.

The Design Document

After TLTG decided to develop a physical science curriculum, the group produced a project design document to guide decisions related to curricular objectives, instructional design, and hardware specifications during the course's development. Involved in the development of this document were physical science students, teachers, school administrators, science coordinators, curriculum specialists from the 12 participating districts, state agency personnel, and nationally known scientists and science educators. They analyzed existing teacher and student physical science materials from participating districts and developed a curriculum outline and target time frame. The design document, completed in February 1986, called for three levels of IVD instruction: teacher-led instruction, small group activities, and individualized instruction.

The Prototype

Using the design document as a guide, AT&T developed a prototype lesson on the topic of the electromagnetic spectrum. Development of the prototype provided a considerable amount of information to aid development of the total curriculum. After completing the prototype, AT&T had to terminate its involvement in the project, prompting TLTG to hire its own staff to develop and produce the curriculum.

Funding

TLTG initially projected that the Interactive Videodisc Physical Science Curriculum would be a three-year, $2 million effort. With an initial three-to-one matching grant from NSCF for $500,000, 12 school districts committed $1,462,000 to the project. But as the project's scope broadened, the effort became a four-year, $4 million endeavor. The remaining development funding came from the following sources: National Science Foundation, Brown Foundation, Lightner-Sams Foundation, Dow Chemical Foundation, Frito Lay, Mobil Oil Foundation, Radian Corporation, Southwestern Bell Foundation, Dunagan Foundation, and support from TASB.

Several other organizations provided TLTG with in-kind support: TASB, IBM, the Texas Education Agency, Radian Corporation, the Educational Testing Service, Los Alamos Laboratories, North Texas State University, Texas A&M University, and the University of Texas at Austin.

Program Description

Rationale and Objectives

The TLTG Interactive Videodisc Physical Science Program is a comprehensive physical science course that integrates teacher/student interactions, teacher demonstrations, and traditional wet labs with an interactive videodisc instructional delivery system.

The TLTG program is designed to:

- Increase students' in-depth understanding and rate of learning of physical science concepts and skills,

- Increase the students' interest in science,
- Show the relevance of physical science to daily life,
- Prepare students for an increasingly technological world, and
- Prepare students for academic and professional advancement in the sciences.

Organization of Course

TLTG's physical science curriculum is a 160-hour, two-semester, comprehensive physical science course that illustrates the same concepts presented in traditional yearlong physical science courses. The courseware consists of 15 instructional units including one introductory unit, seven chemistry units, six physics units, and one unit on energy resources that can be taught at the end of either the chemistry or the physics semester.

Instructional Delivery

Students in the curriculum learn through several methods - traditional science labs, teacher demonstrations, written assignments, and innovative videodisc-based instruction. Two types of videodisc-based instruction are teacher-led instruction, involving the entire class, and small group practice activities, allowing three or four students to work together.

In teacher-led sessions the electronic system captures student interest by presenting topics with entertaining scenarios, humor, and animation. Through interactive video, the teacher can show students experiments that are too dangerous, expensive, or time-consuming to perform in the classroom. At regular intervals, the system poses questions that keep students involved and motivates class discussions on the topics.

Small group electronic practice activities are highly interactive; they constantly elicit student responses and provide helpful feedback. The activities allow students to work at their own pace as they apply the principles they learned during the teacher-led instruction. The group electronic practice includes drill and practice activities, simulations, and electronic labs. Simulations provide students opportunities to develop their quantitative problem-solving skills

(with graphing and mathematical problems) as well as their qualitative problem-solving skills in the context of real world events (e.g., the operation of a nuclear power plant) or fictional scenarios (e.g., an adventure with the characters of Camelot). Students have fun honing important science skills as they engage in these small group electronic activities.

Components of Courseware and Hardware Requirements

The complete 15-unit courseware consists of 14 videodiscs with accompanying software, teacher resource guide, student manual, and student assessment program. The teacher resource guide contains the following materials for each unit: list of objectives, pacing chart, script, summary notes, practice sets, wet labs, suggested demonstrations, and glossary. Hardware requirements include an IBM InfoWindow touch-sensitive color monitor, an MS-DOS compatible or Personal/System 2 computer, a videodisc player, and a 25-inch RGB monitor.

Development

Production of TLTG's Interactive Videodisc Physical Science Curriculum began in September 1986 and was completed in February 1989. Development of the videodisc-based instruction and supporting materials required a coordinated and cooperative effort among TLTG staff, the production company, TLTG's industry partner (IBM), and external coursweware reviewers.

The TLTG staff provided expertise in design, computer programming, graphics production, and development of support materials. The production company provided script writing, special graphics, animation, and video production. And IBM's contributions to the project included hardware support, authoring support, and courseware review.

Throughout the process, an external review was used to ensure high instructional quality and content accuracy. Four categories of reviewers participated: (1) teachers involved with the pilot program; (2) industry physicists and chemists; (3) university professors with expertise in educational technology, science education, chemistry, or physics; and (4) national award-winning science teachers, selected for TLTG by NSCF.

Each unit was reviewed in four phases. The first explored unit objectives and instructional sequence of activities. In the second phase, reviewers checked the script and the accompanying visuals. Then pilot teachers reviewed the curriculum and offered suggestions for improvement in the third phase. And finally, in the fourth phase, field-test teachers reviewed the revised program and suggested further revisions.

Teacher Training

Research indicates extensive support is needed to help teachers integrate technology into the classroom. Therefore, teacher training is a major component of the TLTG program. Training sessions are conducted by TLTG staff members, technical specialists, and university professors. During the field test, pilot teachers who had taught with the program also conducted sessions.

The training sessions are intended to make teachers more comfortable with IVD technology and enhance their abilities to incorporate a technology-based curriculum into the classroom. Teacher training activities include:

- Changing roles of teachers and students using IVD technology,
- Operation of the IVD system,
- Troubleshooting hardware problems,
- Teaching critical thinking skills,
- Managing the entire class using IVD or working with small groups of students,
- Sharing of teaching experiences and effective strategies,
- Designing lesson plans using the TLTG teacher's resource guide, and
- Fielding questions from the press.

TLTG's teacher training schedule calls for one week of training during the summer before teachers begin using the courseware, followed by one day of training in the fall and one day in the spring. Training of field-test teachers currently follows this format. Because the pilot teachers aided TLTG in the design of the courseware and were the first to use the curriculum, they received additional training during the prepilot phase (one week in summer 1986 and one day in fall 1986 and spring 1987).

TLTG sought maximum input from teachers in developing the physical science curriculum, so teacher training sessions also were used to solicit feedback and suggestions from the field. Teachers offered valuable critiques of many aspects of the courseware.

Pilot Evaluation

Quantitative Study

EPC conducted an investigation of student learning with the IVD system and of teacher perceptions of the program. Twelve school districts piloted seven units (Introduction to Physical Science, Nature of Matter, Atomic Structure and the Periodic Table, Chemical Bonds, Solutions, Chemical Reactions, and Acid-Base Chemistry) in the Fall semester of the 1987-88 school year.

Two configurations of the IVD-based delivery of the physical science course were used. In the teacher-only configuration, the classroom was equipped with one work station. In the teacher-group configuration, the classroom arrangement included a teacher station with five group stations, each designed for three or four students. In the group setting students work cooperatively at work stations to solve problems. Seven classrooms had teacher-only configurations and nine classrooms had teacher-group configurations.

Research Questions

Research focused on student achievement and interest in science and on teacher perceptions of the program. The following research questions were posed:

1. Do students learn more physical science concepts using the IVD courseware than they do from the classroom instruction it replaces?
2. Does the amount of learning differ for students with different levels of verbal and quantitative aptitude?
3. Does the amount of learning differ between each of the two system configurations (teacher-only or teacher-group configuration) and the non-IVD students when students' aptitude levels are taken into account?

4. Do students using the IVD courseware acquire more positive attitudes toward science and the study of science than non-IVD students?
5. What are the teachers' perceptions of the TLTG program?

Design

To answer the research questions about student learning, several comparisons between groups were made.

A. *All IVD students (teacher-only and teacher-group) compared with non-IVD students* - Students in an IVD class were compared on measures of attitude and achievement with students in a non-IVD class.

B. *Prepilot students compared with pilot students* - Students in a traditional prepilot class (the year before the IVD system) were compared on measures of achievement with students in a pilot class with the same teacher.

C. *Teacher-only IVD classes compared with non-IVD classes* - Students in the teacher-only configuration were compared with non-IVD students on measures of achievement.

D. *Teacher-group IVD classes compared with non-IVD classes* - Students in the teacher-group configuration were compared with non-IVD students on measures of achievement.

Methodology

Data collection. Data upon which the evaluation is based were collected over a two-year period: September 1986-May 1987 (pre-pilot phase) and September 1987-August 1988 (pilot phase). Teachers used IVD courseware for one semester only. It should be noted that results reflected in this report are based on one semester of exposure rather than the complete, two-semester course.

Twenty-six teachers and 2,560 students in 12 school districts participated in the IVD pilot study. Student records containing all necessary information for analysis totalled 2,297 (IVD pilot) and 338 (pre-pilot). The number of non-IVD students in the pilot was approximately the same as the number of IVD students.

Class rosters, demographic information (grade level, sex, and ethnicity), and attitude, aptitude, and achievement scores were collected. During the pilot phase, teachers administered achievement and aptitude tests during the fall semester.

Students' attitudes, gauged by their intention to enroll in elective science classes, were measured by the High School Science Courses Questionnaire, based on Ajzen's and Fishbein's Theory of Reasoned Action. In May 1988, representative subsets of students from IVD and non-IVD classes in five school districts answered the questionnaire.

Student achievement was measured by the High-School Subject Tests, Physical Science Test, developed by Scott, Foresman and Company, 1980. Students participating in the prepilot phase took the test at the end of the 1987 spring semester, and students in the IVD and non-IVD classes in the pilot phase took the test at the end of the 1987 fall semester.

To measure student aptitude, EPC used the Developing Cognitive Abilities Test (DCAT), constructed by Donald L. Beggs and John T. Mouw of Southern Illinois University. Prepilot (1986) and pilot (1987) students took the test in September.

Teacher perceptions of the program were recorded using a questionnaire prepared by the evaluation team. Under the direction of EPC, the Office of Survey Research at the University of Texas at Austin designed the questionnaire to generate teacher opinions on the usability, use, and effectiveness of the IVD system. Staff members of the Office of Survey Research at the University of Texas conducted the interviews in July 1988.

Data analysis. EPC analyzed the data using meta-analysis techniques, a method of measuring and stating the effects of IVD under varied circumstances and with different comparison groups.

Quantitative scores (math skills) and verbal scores of students taking the aptitude test were used in the analysis. This test was scored on a normal curve equivalent (NCE) scale, with a mean of 50. The high aptitude groups, quantitative and verbal, were composed of persons who scored 60 or higher on the NCE scale; the medium aptitude groups scored 41 to 59 on the NCE; and the low aptitude groups scored 40 or lower.

EPC used the following chemistry subscores (raw score, percentage correct, national percentile) in the analysis for each student taking the achievement test:

- Measuring Mass, Volume, and Distance
- The Particle Nature of Matter
- Structure of the Atom
- Solutions and the Behavior of Matter

Findings on Student Outcomes

Student achievement in chemistry: IVD students versus non-IVD students. In general, IVD students outperformed non-IVD students in all six categories: quantitative and verbal for low-ability; quantitative and verbal for medium-ability; and quantitative and verbal for high-ability.

The differences were greatest, however, for low-ability student groups, especially low-verbal ability; they were next greatest for the medium-verbal ability group. Smaller differences between IVD students and non-IVD students were found in the medium-quantitative category, high-verbal category, and high-quantitative category.

Outcomes were not uniform for students of varying ability types or levels; although, overall, low-ability IVD students tended to benefit the most, surpassing 68 to 79 percent of the low-ability students in non-IVD classrooms.

1988 IVD students versus 1987 non-IVD students with the same teacher. Students taught in 1988 IVD classes performed better than non-IVD students taught by the same teacher in four categories. Students in the low-verbal, medium-quantitative, high-verbal, and high-quantitative categories experienced a slight improvement over the non-IVD students. However, in the two remaining categories, low-quantitative and medium-verbal, non-IVD students outperformed their counterparts in IVD classes.

Teacher-only students versus non-IVD students. The teacher-only arrangement produced moderate advantages for students in the following ability categories: low-verbal, medium-quantitative, medium-verbal, and high-verbal. On the other hand, the non-IVD low-quantitative ability students performed somewhat better than their counterparts in teacher-only IVD clasess and the high-quantitative ability students in non-IVD classes showed the same level of achievement as their counterparts in teacher-only IVD classes.

Teacher-group students versus non-IVD students. Results were substantially supportive of teacher-group IVD students of the low-verbal and low-quantitative ability categories and were moderately supportive of IVD students in the medium-verbal category. Results favored the teacher-group IVD situation for high-quantitative ability students, although differences between IVD and non-IVD students were not drastic. Small differences between medium-quantitative and high-verbal ability groups favored the non-IVD students.

IVD student versus non-IVD student attitudes toward science. The IVD and non-IVD students' attitudes toward science and their intentions to take science as an elective were found to be significantly different. Students in IVD classes expressed a more positive intention to take additional science courses than non-IVD students. This intention was even stronger for those students who previously had not failed math or science in school. IVD students also expressed a more positive attitude toward the study of science than non-IVD students.

Findings from Teacher Survey

Teachers were surveyed at the end of the pilot year to determine their impressions of the effectiveness and usablity of the system. The following are highlights of the survey:

1. 19 of the 20 teachers surveyed rated the IVD system as either "more" or "much more" effective than the methods and materials they ordinarily use.
2. 18 of the 20 teachers surveyed considered IVD to be more effective for some students than for others.

Teachers said the system worked better for average students (four teachers); lower-level students (five teachers); visual learners (five teachers); students with reading problems (two teachers); slower-learning students (four teachers); and less self-motivated students (two teachers).

In other words, teachers in general considered the system to work better for students with learning problems.

3. 17 of the 20 teachers surveyed perceived the simulated labs to be "more" or "much more" effective than other methods of teaching the same concepts.
4. All teachers surveyed rated the content "excellent" or "very good."
5. 18 of the 20 teachers surveyed rated the technical quality "excellent" or "very good" - the remaining two rated technical quality "good."
6. 19 of the 20 teachers surveyed rated the usability "excellent" or "very good" - the remaining one rated it "good."
7. 19 of the 20 teachers surveyed considered the IVD system easy to use - one was neutral.

Summary

On the average, IVD students reached higher levels of achievement than non-IVD students. Differences were greatest between low-ability students in IVD classes and low-ability students in non-IVD classes.

Four of the six types of students in IVD classes had slightly higher achievement levels than students in non-IVD classes with the same teacher.

The low-verbal and low-quantitative students in the teacher-group configuration substantially outperformed the low-ability students in non-IVD situations.

Students taught using the IVD system expressed a more positive intention of taking additional science classes as electives than did non-IVD students and had a more positive attitude toward the study of science.

Teachers, on the whole, found the IVD materials more effective than traditional materials and reported the system worked better for students with learning problems.

All of the teachers rated the content, technical quality, and usability of the system "very good."

Qualitative Study

During the pilot year, TLTG staff members used several qualitative methods to collect data on teacher implementation of the program, teacher and student perceptions of the program, and courseware effectiveness. Information about content accuracy, clarity of the visuals, difficulty level of the instruction, ease of use, and technical problems was included in the data collected on courseware effectiveness.

Data Collection

During the pilot year, the following sources provided data on teachers' and students' reactions to the IVD program, use of the program in the classroom, and the effectiveness of the program.

- Observational reports were based on classroom visits by TLTG staff during the first two weeks of December 1987. One or two staff members observed at least one class period in each classroom in the pilot school districts.
- Pilot teachers critiqued courseware design features and corresponding print materials and sent the critiques to TLTG upon the completion of each chemistry unit.
- Staff members transcribed roundtable discussions on designated topics (e.g., teaching methods with the IVD curriculum, classroom management strategies, courseware navigation, etc.). These roundtable discussions took place during the fall and spring teacher training sessions in the 1987-88 school year.

- Students wrote letters describing what they did and did not like about the IVD program.
- TLTG staff members videotaped selected classrooms equipped with teacher-only stations and teacher-group stations.
- TLTG staff members surveyed teachers' perceptions of the program, including their perceptions of teaching roles and student attitudes and performance. The survey was distributed to the teachers at the spring teacher training session in April 1988.

Findings

The following general trends were gleaned from the aforementioned data sources.

Use of TLTG program materials in the classroom. Effectiveness of the IVD materials in the classroom hinged on the following factors:

1. Teachers used a variety of instructional delivery methods in a class period, including demonstrations, lectures that provided reviews or previews, the electronic instructional sequence, and practice sets or electronic practice. General consensus among teachers was that students' attention spans with the IVD instructional sequence was 20-30 minutes and student participation was greatest when a balance existed between IVD instruction and supporting materials.
2. During the 20-30 minute electronic instructional sequence 75 to 100 percent of the students paid attention to the video.
3. Teacher control and student motivation was a major factor in the number of students who were attentive to the IVD system.
4. Generally, students in video-based small group activities were highly involved and engaged in a great deal of group discussion.
5. When interacting with the electronic group activities, the most effective group size was three to four students.

6. Grouping strategies for the small group activities differed. Some teachers allowed students to choose partners, other teachers grouped high- and low-ability students or introverts and extroverts together.

Teacher perceptions of the TLTG program. Teachers using the IVD curriculum expressed the following reactions to the program:

1. Teachers liked using the TLTG curriculum.
2. Teachers experiencing an increase in student attention from previous years noticed a reduction in discipline problems.
3. Some teachers experienced increased control over their classes because the program helped them organize and structure the instructional materials.
4. Teachers maintained that students not only learned more with IVD instructional materials but also enjoyed learning more than students who learned with traditional methods.

Student perceptions of the TLTG program. Students who used the IVD curriculum contributed the following information regarding program effectiveness:

1. A large number of students reported the system made learning fun. Comments that reflect the sentiment of most of the students are as follows: "It makes science a lot more fun, and it makes it easier to understand." "It brings life to the classroom!" "It's awesome." One student even said, "I hope to see this system put in every school in America so all minds can flourish like mine is...due to this system."
2. Students maintained that the interaction of the TLTG system held their attention much better than teacher lectures or textbooks.
3. Long sections (e.g., two minutes) of linear video, without any interaction, did not hold students' attention.
4. Students appreciated the ability to replay a section as many times as necessary to learn something difficult.
5. Students requested a larger monitor and larger, brighter text to make it more visible.

6. Students liked the small group video simulations best. They enjoyed the opportunity to work at their own pace and discuss problems with peers.
7. Students disliked the computer speech chip feedback. They also recommended more variety in feedback.

Design issues related to courseware effectiveness. Following are highlights of feedback on design issues that were addressed during the revision process in the Spring of 1988:

1. When questions were posed during the teacher-led instructional sequence, teachers preferred to give students feedback on whether answers are correct, rather than having the computer provide the feedback.
2. Teachers recommended an answer screen follow a question.
3. For the most part, the teacher-led instructional sequence paused at the appropriate times. Text should appear on a paused screen to cue teachers what to comment on.
4. Most teachers used the User Control features regularly with few problems. Several found it hard to touch the Stop icon in the right place.
5. Generally, the difficulty level of the simulations was on target for ninth-grade students. It was recommended that varied difficulty levels be added to those simulations considered to be too simple or too difficult.

Summary

This study suggests that an IVD-based curriculum is more effective than traditional materials. On the whole, the curriculum made a difference in student learning. In addition to increased enthusiasm and active participation in learning, students experienced an increased achievement in chemistry.

Teachers reacted favorably to the technology-based system and were encouraged by student receptiveness. Positive attitudes by teachers and students, along with the multi-media instructional approach, helped create a rich learning climate in the classroom. This study also suggests that the goal of increasing student interest and achievement in science is being realized.

This investigation implies that further research would not only be worthwhile, but imperative in shedding more light on the effect of technology on learning. Additional research could include following up on students' intentions to enroll in science classes, tracking students' choices of careers, investigating student achievement in subsequent science courses, and exploring student learning and teaching effectiveness with interactive videodisc.

TLTG Direction

The physical science curriculum is in its second year of testing with 20 additional Texas districts and three additional states: Washington, Indiana, and Louisiana. TEA supported the field test through available Chapter 2 and Title II funds. Areas of emphasis in the year's evaluation are student achievement (in content and process skills), intent to enroll in elective science courses, student/teacher perceptions of interactive videodisc, and teacher implementation.

Within the past year both national and international organizations honored TLTG for its contributions to interactive videodisc technology. The Nebraska Videodisc Design/Production Group gave TLTG the Best Educational Achievement award. This national award recognizes outstanding contributions to the development and implementation of videodisc technology. TLTG also received a Silver Reel Award for a physical science unit entered at the 20th Annual International Television Association Video Festival. The unit was judged on design, creativity, production quality, and appropriate use of interactive medium.

In 1989, TLTG is looking toward marketing the physical science course nationally and beginning the development of a second curriculum. With this second development effort, TLTG welcomes the opportunity to make instruction even more effective and efficient in the classroom. Studies show that the United States is far behind many other nations in mathematics and science education. TLTG's response to this status is to continue challenging students to become increasingly interested in science and mathematics through motivational, technology-based curricula.